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REPORT

ON THE

SURVEY OF THE

BANGOR, ORONO AND OLDTOWN

RAIL-ROAD.

WITH REMARKS

ON ITS

ADVANTAGES AND PROBABLE REVENUE.

BY

A. C. MORTON,

CIVIL ENGINEER.

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PORTLAND, FEBRUARY 18, 1850.

To I. WASHBURN, JR., DANIEL WHITE and N. H. ALLEN, Esq's
*Committee for procuring a survey of the Bangor, Orono and Old-
town Rail Road:*

GENTLEMEN:—A careful survey has been made of the route of your road, under my direction, and I have now the honor to submit a report thereon, together with maps, profiles and estimates of cost.

The topographical features of that part of the Penobscot valley embraced in this survey, are marked and prominent, presenting elevated and somewhat irregular table grounds, putting out from the main slopes of the valley, and forming bold shores for much of the distance on each side of the river. On that portion of the route between Orono and Oldtown, these table lands are less elevated and the slopes of the banks more gentle. Their being no alluvial bottom grounds, the river is confined to the main channels except in very extraordinary freshets, and it has generally a direct south-westerly course except at one point where it deviates by a bold and circuitous sweep. The average fall of the river from Oldtown to the head of tide water, is 9 feet per mile, but this fall mostly occurs at points where the river is available and already extensively used for manufacturing purposes.

The prevailing soil of that part of the route between Orono and Oldtown is sand and gravel, and although on the whole route taken together, there are occasional points of rock and clay, yet a soil of a gravelly loam and sandy character largely predominates.

The line of survey commences at the mouth of the Kenduskeag river, in the city of Bangor, and follows the banks of the Penobscot, with few exceptions, the whole distance.

Within the corporate limits of the city, the line follows near the wharves of the river, passing under the trestle work which

forms the approach to the Penobscot bridge, thence continuing between the river and Washington and Hancock streets, it conforms to the general outlines of the shore to Newbury street.—The ground for the whole of this distance, permits the grade of the road to be so arranged as will best accommodate the transfer of freight to vessels in the river, and at the same time, not require any cuttings or fillings interfering with the grade of the streets, or preventing a favorable approach to the river at any point.

Soon after passing Newbury street the line encounters a ledge of slate rock, which presents nearly a perpendicular face to the river. The strata of this rock are in nearly a vertical position, and it apparently contains a large proportion of silex, giving it a blue shade, and a compact character. This will not be a thorough cut, consequently the quantity to be excavated and the labour required to accomplish it will be materially reduced.

At the Rose place, there is another ledge requiring an increased amount of this excavation, and there will also be some rock cutting near the red bridge.

The aggregate amount of rock excavation, in the first two miles, is about 14,000 cubic yards, and this comprises the largest item of expense in the grading of this distance.

At a point about half a mile above the Rose place, the river has encroached upon the west bank, which is of a light gravelly character, till it has reached the travelled road, forming a deep indentation in the shore. At the Red bridge there is another indentation of less extent, formed at the mouth of a small stream which enters the river at that place.

To pass these points in the most economical manner consistent with a reasonable amount of curvature, requires that the public highway should be crossed twice. This may appear highly objectionable, yet the travel will be so much reduced after the road shall have been built, as to render it of comparatively little importance. It is practicable to change the public road to keep it on the west side of the rail road, but from the rocky and irregular character of the ground, this would be expensive, making the road more uneven and probably throwing it in rear of some of the buildings erected near the present road. No provision therefore is made in the estimate for changing the road from its present position.

From the Red bridge, two lines have been surveyed, one following the circuitous route of the river, and the other a more direct course by an interior route. These lines unite at a point near the Basin Mills.

INTERIOR LINE.

At the diverging point, this line leaves the river, following up the valley of a small stream to its source, a distance of about one and a half miles; thence by a deep cut it crosses to the valley of another small stream, which it follows down to a point near the Bangor and Orono road, a short distance beyond North Bangor; thence continuing the same general course it leaves the valley, crosses the road and the high ground skirting the river, by another deep cut, and attains the bank of the river which it follows on ground nearly in common with the river line, to the point of intersection near the Basin Mills.

The dividing ridge, which forms the summit is 106 feet above the diverging point and 126 feet above the river at the Red bridge.

The length of the summit cut is about 1,500 feet and its greatest depth is 47 feet.

The appearance of the surface of the ground indicates that the material in the cut will be of a favorable character, but in a work of this magnitude it is difficult to arrive at satisfactory conclusions as to the nature of the material, without boring or sinking test pits. Circumstances did not permit us to do this in the present survey; but before making a final location, a careful examination of this ridge should be made.

This cut contains 174,000 cubic yards of earth, which will mostly be deposited in spoil banks near each extremity.

The cut encountered as the line approaches the river, has the same general appearance as to the nature of the earth. Its length is 1,600 feet, the greatest depth of cutting is 36 feet, and it contains 90,000 cubic yards. At the point where the line crosses the road, the cutting is 17 feet, which permits the public highway to pass over the rail road by a bridge.

The length of this line is 4.87 miles. In reaching the summit on this line, a grade of 43.6 feet per mile ascending in the direction of Orono, is required, and in the opposite direction a grade of

10 feet per mile. The estimated cost of the road for this distance, making such allowances for unforeseen difficulties as the magnitude of the work may seem to require, is, when complete with a single track, \$149,287.

RIVER LINE.

This line is located along the bank of the river, encountering no heavy work of any extent until it reaches Thompson's Point. At this place the river has a very abrupt bend, and the ground embraced in this detour is a somewhat elevated table. In order to ease the curvature it is necessary to cross this table a short distance back from the river, and in doing this, a cut of considerable magnitude is encountered.

The material to be removed is apparently of a favorable character and will be deposited on the bank of the river at each end of the cut.

This cut is 2,600 feet in length, with a maximum depth of 23 feet. It is estimated to contain 88,000 cubic yards. A portion of this work however will not be thorough cutting.

The line approaches this point on an inclination of 25 feet per mile, and the minimum radius of curvature passing it is 955 feet. This radius may be enlarged to 1,146 feet without materially increasing the expense.

After passing this place, the line is located generally over favorable ground, to Corporation Mills, a distance of 4 1-2 miles from Bangor.

The line and the grade are so arranged as to permit a branch from these mills to unite with the main road below the mills in a favorable manner.

The next point where heavy work is encountered, is about one mile above Corporation Mills, where a large amount of protection wall is required, and a deep side-hill cut. Thence the line follows along nearly the same ground as the interior line, to the point of intersection.

The grades of this line are either level or descending in the direction of Bangor. The maximum grade is 25 feet per mile. The length of this line is 5.70 miles. Cost of grading and single track on this route \$151,298. The following table exhibits the leading features of these lines.

ITEMS.	River Line	Int'or Line	Difference
Length—miles, - - - - -	5.70	4.87	0.83
Number of summits, - - - - -	0	1	1
Maximum grade—feet per mile, - - - - -	25	43.6	18.6
Length of do.—feet, - - - - -	3,800	7,500	3,700
Maximum grade—against trade of Road, - - - - -	Level	10	10
Length of grade—feet, - - - - -	- - - -	18,100	18,100
Rise and fall—feet, - - - - -	30	106	76
Curvature—degrees, - - - - -	413	80	333
Minimum Radius curvature—feet, - - - - -	955	1,146	191
Cost of Grading, Bridging and track, - - - - -	\$154,298	\$149,287	\$5,011

From the above it appears that the River line is over 3-4 of a mile longer than the Interior line, that it has 333 degrees more curvature, and that the cost exceeds that of the Interior line five thousand and eleven dollars.

The grades and the rise and fall, however, on the Interior line are much more unfavorable than on the River line.

The maximum grade of the Interior line is 43.6 feet per mile for a distance of nearly one and a half miles, while that of the River line is only 25 feet per mile for about three fourths of a mile.

The Interior line has a summit to overcome which requires an ascending grade in the direction of Bangor, of 10 feet per mile for a distance of nearly 3 1-2 miles.

The River line has grades either level or descending towards Bangor for the whole distance.

The preponderance of the tonnage of the road is largely in that direction. Your road will be a heavy freight road, lumber being the principal article of transport, all of which will be downward freight.

Adopting the Interior route, the grade of 10 feet per mile, controls the tonnage of all the trains for the whole road; all other portions of the road are either level or descending in the direction of the greatest tonnage. An Engine with 20 tons on the Drivers, allowing 1-8th of the insistant weight for adhesion, and 8 lbs per ton for friction, will haul up this grade, a gross load of 447 tons. This, therefore, would be the limit ordinarily with such an engine.

Adopting the River route, which conforms nearly as it regards gradients to all other portions of the road, and omitting allowances for curvature in both cases, the same Engine under the same circumstances will haul a gross load of 700 tons. This shows the

effect of grades on the economy of transportation. Without going into the details of this subject, which is quite unnecessary on the present occasion, I will only farther remark that the question will be modified by the nature and amount of traffic.

If the trade is of such a character as to render it probable that Engines will seldom be loaded to the full extent of their power, then the objection to this grade applies with less force; but if on the other hand, the business is such as to require the frequent passage of trains loaded to the full power of the Engine, then it has an important bearing on the subject of transportation.

Judging from the character and amount of the trade to be accommodated by your road, it is believed that Freight Engines will usually be taxed to near their full power in the downward trains.

The primary object of your road, is to accommodate all the mills and villages along the river. The Interior line leaves the river below and strikes it above the Corporation Mills, and its position is such as not to permit the construction of a branch connecting these mills and the road, at a reasonable expense, or with such grades and curvature, as would afford sufficient facilities to command the business. The question then arises as to the amount of business these mills will furnish, and whether it will be of sufficient importance to have a material bearing on the subject of location of the road.

These mills are situated at a point below difficult rafting navigation, and the cost and risk of forwarding lumber by the river is less than from other mills above.

The lumber however thus forwarded from these mills, will be subject to the same deterioration, from being put into the water as that forwarded from other mills. The value of the business of this place, so far as it has a bearing upon the location of your road, should be more definitely ascertained, and receive all proper consideration before finally determining on the route you will adopt. The River line, as before stated passes these mills, affording all the requisite facilities of transportation.

The obstructions which may be expected from deep snows will doubtless be greater on the Interior than on the River route, on account of the position of the line and the greater extent of deep cuttings. The cuttings on the River route are with one exception side-hill cuts, which will readily permit the snow to be thrown down the sloping bank of the river.

As to the repairs of the road, the greater extent of line and the greater exposure of the River route will make the annual expenditure for this object greater on this, than on the Interior route. In connection with this subject I would again observe, that the estimates have been made without that thorough examination of the deep cuts, by test pits, which is necessary to a more full knowledge of the character of the work. A careful location of the line and examination of the work may essentially change the estimate of the Interior route. The character of the work on the River route is more clearly indicated in the slopes of the bank of the river.

The above are the principal facts developed by our hasty survey, together with some of the considerations to be kept in view hereafter, in making more thorough examinations with a view to the definitive location of your road.

From a point about 3-4 of a mile below the Basin mills, both lines bear more westerly, and leaving the immediate bank of the river, follow up the valley of a small stream a short distance, thence passing a dividing ridge they strike another small stream running northerly, and follow up the west slope of the valley to the point of intersection near the Basin mills.

The work upon this portion of the route is light. The river line is level from Thompson's point to these mills, a distance of 4 miles, while the Interior line as before observed, occupying slightly higher ground upon the slope, descends at an inclination of ten feet per mile. The ground here permits either line to be located both as it regards alignment and grade, so as to facilitate a connection with these important mills by a branch track.

From these mills to the village of Orono, the distance is about one mile. In passing that place two lines have been surveyed, designated Upper and Lower lines.

From the above mentioned mills these lines follow along the western slope of the valley, nearly on the same ground till they reach the upper end of the Basin, in rear of the village where they diverge, the upper line bearing easterly by a curve of 2865 feet radius and passing through the upper part of the village, crosses Stillwater river above the mills. The Lower line bears still more easterly by a curve of 1,146 feet radius, crosses a de-

pression near the Basin and passing through the lower part of the village, crosses Stillwater river below the mills, and intersects the upper line at a point about 3-4 of a mile beyond the village.

The following tabular statement shows the characteristics of these lines.

ITEMS.	Upper line	Lower line.	Difference.
Length of line—miles, - - -	2.59	2.61	02
Maximum Grade—feet per mile, - -	41	19	22
Length of Grade—feet, - - -	3,600	4,700	1,100
Maximum Grade against trade of road, - -	19	Level	19
Length of Grade—feet, - - -	3,000	- - -	3,000
Rise and Fall—feet, - - -	40	18	22
Curvature—degrees, - - -	53	127	74
Minimum Radius of curvature, - - -	2,865	1,146	1,719
Length of Truss Bridging—feet, - -	1,100	580	520
Cost of Grading, Bridging and Track,	\$76,850	\$64,813	\$12,037

From an inspection of the above table, it will be seen that the Lower line is superior to the upper in every respect, except the curvature. The difference in curvature is no material objection to the Lower line. It accommodates the business of the village and the mills on both sides of the river better than the upper line and as the road can also be maintained and operated at less expense on this line, its adoption is recommended.

This line is located in a favorable manner to permit branches to all the mills in Orono.

In passing through Orono by either of the lines surveyed there will be a cutting of 25 feet depth required, consequently all the streets except one, will be carried over the rail road by bridges. Mill street crossing is nearly on a level with the grade of the road and this point offers a suitable location for the depot. After passing the point of intersection, the line soon reaches the banks of the Penobscot, which it follows the whole distance to Oldtown. The soil is uniformly of a favorable character, and the work light. The grades and curvature are also easy.

The line crosses the river road several times, which may be changed so as to avoid a number of these crossings. Great Works mills are passed in a favorable manner for the construction of a branch to accommodate the business on both sides of the river, should it be thought of sufficient importance to warrant the ex-

pense. West Great Works will be reached at comparatively small expense. To reach East Great Works will require about 290 feet of bridging and a considerable amount of other work.

A short distance above this, lower Oldtown mills are passed, which may also be reached with a branch at moderate expense.

Near this place the line running to Milford diverges, crosses the west branch of the river below and the East branch above the bridge. These bridges will require two spans each. The shore and the bottom of the river where the piers will be founded will be mostly rock. The position of this line is such, immediately after crossing, as to permit it to be continued in a direct course up the river and also so extended as to accomodate the business of the village and the mills on that side of the river.

In reaching the wharf at Oldtown, the line passes through the village without causing much damage to buildings or property and also passes near the mills on that side of the river.

The total distance from the Kenduskeag in the city of Bangor to the wharf in Oldtown is 13.75 miles and to the terminus in Milford about the same distance.

The following table exhibits the grades of your road.

No. of Grade.	Length miles.	Ascent per mile	Rise, feet.	Total el'n above tide	REMARKS.
1	0.50	Level	- - -	5.0	Bangor.
2	1.82	8.8	16.0	21.0	Red Bridge.
3	0.83	4.8	4.0	25.0	
4	0.72	25.0	18.0	43.0	Thompson's Point.
5	0.99	Level	- - -	43.0	North Bangor Station.
6	3.04	1.0	3.0	46.0	Basin Mills.
7	0.89	19.0	17.0	63.0	Orono Village.
8	1.45	Level	- - -	63.0	Stillwater River.
9	1.62	10.5	17.0	80.0	Great Works.
10	0.79	Level	- - -	80.0	Lower Oldtown.
11	0.34	20.5	7.0	87.0	do. do.
12	0.57	16.0	9.0	96.0	Upper do.
13	0.19	Level	- - -	96.0	Veazie's Wharf.

ESTIMATES.

The estimates are made for a road of the most permanent and superior character.

The road-bed to be for a single track 15 feet wide on embankments, and 26 feet in excavations. It is placed at such an elevation as to be out of the reach of floods, and is to be rendered secure where exposed to the river, by massive protection walls.

The grades are so arranged as to descend with the preponderance of the trade, which is an important and valuable feature, adding materially to the capacity of your road and lessening the expense of operating it. The line of your road follows ground of a peculiar character, being, for much of the distance, along the slopes of high banks; and it has been located with a view to give the road-bed great stability, and at the same time secure the advantages resulting from the peculiar arrangement of the grades above referred to. Although this has somewhat increased the expense of construction above what it would be with undulating grades, yet the advantages thus obtained are regarded of far greater value than the additional cost.

The truss bridging to be of the most approved form, and the masonry of a substantial character.

The track of the road is intended to be, in all respects, equal to any in New England, and to be of such plan as may hereafter be deemed best to accomplish the object in view. Estimates of two descriptions of track are submitted, one for a cross sleeper and one for a continuous bearing track.

1st. A cross sleeper track having sleepers 7 inch face and thickness, and 7 1-2 feet long, and to be placed at such distances apart as to require 8 sleepers to each bar of 18 feet length, the rail being supported at its extremities by the largest sleepers, with less interval between them and the adjoining sleepers than for others. These sleepers to be laid on a ballasting of clean gravel and well consolidated.

The rail to weigh not less than 63 lbs. per yard, or about 100 tons to the mile, and to be secured to the sleepers by spikes and chains of approved pattern. Such a track is estimated to cost \$6,514 per mile.

2nd. A continuous bearing track, consisting of longitudinal sills 8 inches thick, 12 inches wide and not less than 18 feet long, supported at the joints by blocks 3 feet long, 5 inches thick, and of the same width as the sills. The sills and blocks to be secured by trenails, and thoroughly embedded in gravel and brought to a firm and uniform bearing.

The sills to be connected transversely by haemetac ties 7 feet long, 3 inches thick and 6 inches wide, inserted in the top of the sill at intervals of 6 feet, by a dovetail joint and secured by keys

of the same description of timber. The surface of the sills and ties to be on the same plane, upon which the rail has a true and even bearing, its whole length, and is firmly secured with chairs, centre plates and spikes.

The rails to be 18 feet long, and to weigh 63 lbs per yard. The estimated cost of such a track is \$7,153 per mile. Difference in first cost, in favor of cross sleeper track, \$639 per mile.

The continuous bearing track is more safe, the motion easier, and the wear and tear of machinery and rails far less than on the cross sleeper track. A rail of 63 lbs per yard on a continuous bearing, is equal in stiffness to a 75 lbs. rail of the same pattern on a cross sleeper track, and therefore greater efficiency and durability are secured to the iron and the machinery of the road with the same weight of rail.

The cross sleeper track is embraced in the general estimate; but if a continuous bearing with the same weight of rail is adopted, the sum of \$9,213 should be added to the estimate.

Adopting a rail of 55 lbs. per yard on a continuous bearing, and the cost is reduced to the same amount as that of a cross sleeper track as above described.

The amount of machinery embraced in the estimate, is believed to be sufficient to commence operations with, yet a large business would require some further additions. The buildings are supposed to be of wood, but of dimensions which will afford extensive accommodations.

The cost of land and damages is always a matter of much uncertainty, but the sum embraced in the estimate for these items, appears to be liberal, and it is believed to be sufficient for the purpose.

Summary of the Cost of the Road.

Grading, bridging, &c. as per statement A,	\$234,300
14.41 miles of main and side track, at \$6,514, B,	93,867
Average cost of grading and track per mile, \$23,866,	
Cars and engines, as per statement C,	67,600
Station buildings, " D,	18,500
Branches to accommodate mills, " E,	40,984
Turning tables,	5,000
Land and damages,	37,000
Total cost to Oldtown,	<u>\$497,251</u>

To carry the road to Milford requires a further expenditure of

43,691

Total cost to Oldtown and Milford, \$510,912

BUSINESS OF THE ROAD.

In considering the question of the amount of business which will naturally be drawn to your road, it is proper that we not only refer to the local trade along the line and vicinity, but to the position which it will occupy with reference to other works, its probable extension, and the increase of business which will follow the opening of the great central line through the State.

Your road, while it possesses the advantages of the ordinary business of rail roads to an amount nearly or quite equal to the most favored, has in addition to this, the very large trade which will accrue from the manufacture of lumber along its line, to an extent probably unequalled within the same limits, in the United States.

Oldtown is at the foot of slack water, in the Penobscot, and from this place to tide water at Bangor, there is a fall of 92 feet, much of which is improved for the manufacture of lumber.

The logs are floated down the Penobscot to the mills at various points within this distance, where they are taken from the river, manufactured into lumber to be again returned to the river and rafted to Bangor.

Proceeding up the river, the first point reached where lumber is manufactured, is the Corporation Mills, at North Bangor, a distance of about 4 1-2 miles from the city of Bangor. These mills contain 3 gangs of saws and 22 single saws, equal in capacity to 31 single saws. There are also 1 stave, 1 door and sash, and 2 lath machines. These mills are capable of annually manufacturing 28 millions of feet of lumber, 7 millions of laths, 1 1-2 million of staves, and 100,000 feet door stuff. This village contains four stores and about 800 inhabitants.

Basin Mills are 8 miles from Bangor. There are at this place 2 gangs of saws and 16 single saws, equal to 22 single saws, 3 lath, 1 clapboard, and 2 shingle machines. The capacity of

these mills is about 20 millions feet of lumber, 2 millions shingles, 6 millions laths, and 800,000 clapboards.

The next important point on your line, is Orono village, which is nearly 9 miles from Bangor. The Stillwater mills are situated here and operate 7 gangs of saws and 52 single saws, equal in capacity to 73 single saws. There are also 22 lath, 1 clapboard and 2 heading machines; 1 oar and 4 barrel manufactories, 1 sash, blind and door stuff factory, 1 grist mill, 2 machine shops and 1 stove factory.

The capacity of these mills and machinaes, is 62 millions feet of lumber, 19 millions laths, 2,200,000 clapboards, 2 millions shingles, 500,000 pickets, 20,000 barrels, 60,000 oars and 40,000 staves. The village of Orono contains 14 stores, 3 public houses and several furniture, carriage makers and smith shops. The population is about 2,200.

At East and West Great Works, there are 3 gangs of saws and 30 single saws, equal to 39 single saws, 9 lath, 2 shingle, 3 clapboard machines and 1 barrel factory. These mills can manufacture, annually, 32 millions feet of lumber, 12 millions of laths, 3 millions shingles, 3 millions clapboards, 300,000 pickets and 10,000 barrels. There are here 3 stores and 800 inhabitants.

At Oldtown, there are 17 single saws, 2 lath, 3 shingle, 3 clapboard and 1 turning machines; 2 machine shops and 1 grist mill. This machinery is capable of producing 17 millions feet of lumber, 3 millions of laths, 4 millions clapboards, and 5 millions shingles, annually. Oldtown village contains 18 stores, 3 public houses and the usual number of shops, &c., and about 2,200 inhabitants.

At Milford, there are 17 single saws, 3 lath, 2 clapboard and 2 shingle machines and 1 grist mill. There can be manufactured here, 17 millions feet of lumber, 3 millions laths, 4 millions clapboards and 5 millions shingles. There are here 7 stores and 500 inhabitants.

The above comprises all the mills along the line of your road, for the manufacture of lumber and other products of the forest. It will be observed that these mills, with a favorable season, can manufacture an aggregate of 176 millions feet of lumber, 14 millions clapboards, 1,540,000 staves, 50 millions laths,

17 millions shingles, 800,000 pickets, 30,000 barrels and 60,000 oars.

The amount actually produced is generally below these aggregates; it being regulated somewhat by the market, the number of logs got out, &c., &c.

The question arises as to the amount of this lumber which will be likely to take the railroad in preference to the usual mode of reaching the market. In order to a more full understanding of the subject, it becomes necessary to consider somewhat in detail the present mode of transportation, the difficulties attending it, and the cost resulting not only from the charges for rafting, but losses and damages sustained from various causes.

It is stated by persons connected with the business and having every facility to determine, with much accuracy, the extent of this trade, that the annual average amount of lumber which was manufactured on the Penobscot and on the line of this route, and arrived at Bangor during the years 1846, '47 and '48, was not less than 150 millions of feet. Owing to a great depression in the trade and an unprecedented drouth, the amount for 1849, was much less than for the previous three years: but it probably has ranged for a term of years, between 120 and 160 millions of feet, annually.

For our present purpose, we shall be sufficiently near the average annual amount if we assume 130 millions of feet; and apportioning this quantity to the different mills according to their capacity, as above stated, we have the following as the amount from each place:

North Bangor,	20,000,000 feet.
Orono,	61,000,000 "
East and West Great Works,	23,000,000 "
Oldtown and Milford,	26,000,000 "

With this amount, we may safely suppose that two-thirds would consist of the first and second qualities of lumber; and we may place the average price for these qualities, at \$12 per thousand feet.

At a favorable stage of the water, the amount of lumber in each raft, varies from 20 to 30,000 feet; averaging, probably, about 25,000 feet each.

In making up rafts, it is necessary to have 12 snubbers and 4 sweepstakes, as they are termed, in order to bind the parts well together for passing the dams, rapids, &c.; these cost 1 1-2 cents each, equal to 24 cents for a raft, or about one cent per thousand feet.

In putting together a raft, much lumber is damaged by boring and splitting. The amount thus injured is estimated at about 800 feet, or equal to the total destruction of 400 feet for each raft, which, at the average price of \$12 per thousand, amounts to \$4,80, or 19 cents per thousand on the lumber in each raft.

There are losses sustained from the destruction of the whole or parts of rafts in passing dams, or from being dashed upon rocks and reefs. There are 30 men on the river, who devote their whole time during the rafting season, to picking up the lumber from broken rafts and towing it ashore. This is disposed of solely for their own benefit, and doubtless amounts to at least \$1,50 per day for each man. This for 150 days, gives a total loss during the rafting season, of \$6,750, which is equal to over 5 cents per thousand on 130 millions feet, the average amount assumed for each season.

The above are items about which there can be little or no doubt, and may be determined with a reasonable degree of precision. There are other losses and damages, however, which are also properly chargeable to the transportation of lumber by the river; but these are not so easily reduced to definite amounts, and therefore they will be considered separately and in another place.

Collecting those items together, however, to which we have affixed a definite value, and adding them to the cost of rafting from each place, we have the following statement which shows the present cost of transportation, exclusive of the other expenses to be hereafter considered.

ITEMS OF EXPENSE.	Corporation Mills.	Oreno Mills.	Great Works Mills.	Oldtown and Milledale Mills.
Rafting Lumber,	15c	25c	37 1-2	42c
Injury to do.	9	19	19	19
Snubbers, &c.	1-2	1	1	1
Lumber lost,	2	5	5	5
TOTALS.	26 1-2	50	62 1-2	67

In the above statement, I have put down the injury to lumber, and lumber lost in rafting from Corporation mills, at about one half of what it is from other mills above, on account of less exposure.

Applying the cost per thousand for each place as above determined, to the total amount of lumber estimated for each, and the average cost of transportation is 51 cents per thousand feet. Excluding Corporation mills and the average cost from Orono and all places above, is 56 cents per thousand feet

It is important, however, to bear in mind, that this does not by any means, show the actual cost of transporting lumber on the river, inasmuch as it is subject to other charges from injury and deterioration. The above losses are sustained during ordinarily good rafting navigation; but during a portion of each year (or at least four seasons out of five) the water is so low as to render rafting difficult, when not more than 10,000 feet can be run in each raft. At such seasons the damage from being worn, bruised, split and broken, is materially increased; and not unfrequently, rafts are delayed in the passage from the mills to Bangor, one or two weeks,—and this often when the lumber is greatly wanted in the market. The necessity, during low water, of running only about half the usual amount of lumber in each raft, must materially increase the expense of rafting; and although, with the present arrangement, this falls only on the raftsmen, yet the owners suffer severely in the delay and increased damages, and the considerable sums which must frequently be paid for getting rafts off from rocks, &c.

This, therefore, and the large amount of lumber which arrives at market in an injured state, are important items of expense. There remains, however, still another item to be added to the cost of transportation by the river, which probably is equal to all others, if we exclude the expense simply of running the rafts. This is the deterioration of lumber from being put into the water, by which it is discolored, soiled and saturated, and the market value considerably reduced.

This injury is principally sustained by the first and second qualities of lumber.

We will not attempt to determine, definitely, the amount of damage for each of the items above enumerated.

Intelligent dealers in lumber, who, from long experience, are best capable of judging of this question, estimate the damage to the better qualities of lumber from being water soaked and soiled alone, at not less than 50 cents per thousand feet.

This and the other losses from detention at low water, from lumber bruised, split, &c., should be added whatever the amount may be, to the footing in the preceding table in order to give the actual and total cost of transportation. It does not appear probable, if we pay due regard to the experience and opinion of the most competent judges, that the amount of the several losses just enumerated, would fall short of 50 cents per thousand feet.

But to guard against an over estimate of these items, we will assume the loss at only half that sum, or 25 cents per thousand for the first and second qualities.

If this be correct, then the actual cost of transporting this description of lumber to Bangor, in rafts, is as follows:

North Bangor,	52	cents	per	thousand.
Orono,	75	"	"	"
East and West Great Works,	87½	"	"	"
Oldtown and Milford,	92	"	"	"

Or an average cost of 77 cents per thousand.

We have now glanced at the expense and difficulties attending the transit of lumber to market by the river; and it remains for us to consider whether the construction of your road will offer such facilities as will secure to it this valuable branch of trade.

The line of your road is so located as to allow the construction of branches to every mill on the river within these limits; and these branches may approach them in a favorable manner for the reception of the lumber from the mills immediately on to the cars.

A knowledge of the amount of lumber which is required to be forwarded to market, daily, from each of the mills, will readily suggest the number of cars which should be left, daily, at each place to be loaded.

The labor of loading, it is believed, will be less than placing the lumber in rafts, and the work will be of a more simple character, admitting of the employment of a different and more economical class of laborers, or of accomplishing greater results with the same description of workmen.

The manufacturers of lumber having the facilities of forwarding it clean, dry and fresh from the mills, with the greatest despatch and regularity, will be enabled to regulate their business to suit the market, or the circumstances in which they may be placed. If there should not be room to deposit lumber at Bangor, or from the absence of vessels in which to ship lumber, it should not be desirable to forward it immediately, then it may be piled convenient to the branches of the several mills, till such time as it is required to be forwarded, when a large quantity may be delivered with the greatest certainty and despatch, and in the most perfect order.

With the same class of freight engines as are now used on the Atlantic and St. Lawrence Rail Road, 270,000 feet of lumber may be transported from Oldtown to Bangor, on one train in one hour; or stopping at all the mills and attaching additional cars, the time for the same amount of lumber need not exceed two hours.

With the requisite supply of cars, and no delay from loading, three round trips could be made with one engine, per day, transporting 810,000 feet of lumber. This, perhaps, in ordinary practice, could not be accomplished every day, with one engine; not, however, from the incapability of the engine to perform the service, but from the delay at each terminus and the way stations in the changing and distribution of cars, &c.

With a full equipment for your road, and such accommodations as are within your reach at Bangor and at the mills, not the least difficulty need be apprehended in transporting, annually, as large an amount of lumber as has ever been manufactured in any one year by all the mills along its line.

The capacity of your road, the grades being level or descending with the trade, will be superior to any single track road in New England.

Extensive accommodations should be provided for the business of your road at the Bangor terminus. Wharves should be extended up the river from the Kenduskeag to the Penobscot bridge, upon which tracks should be laid; and along which, vessels may lay and receive their cargoes immediately from the cars. The same mode of disposing of the lumber may be resorted to in the Kenduskeag, by extending a track along the

wharves. If circumstances should render it advisable, and with a view to give more extensive accommodations for this business, wharves should be arranged above the bridge for the transfer of lumber to scows, which, when loaded, would convey their lumber to such vessels as may be waiting for its reception.

With the proper machinery, whole car loads of lumber may be transferred at once to scows, or to a place of temporary deposit, the whole operation occupying but a few minutes. So also it may be arranged to run cars on board of scows at high tide, and thus transfer the lumber directly from the cars to the vessels.

The ability to deliver a large amount of lumber in a limited time and with the greatest certainty, thereby permitting it to be retained at the mills where there is more room for storage, till ready to be shipped, the freedom from losses or injury, the great facilities which are at command for transferring lumber to vessels or other places of deposit in Bangor, and the complete control given to dealers over their business, are advantages, which, with a proper tariff of charges for conveyance, should insure to the road the transportation of all the best quality of lumber, and a large portion of the inferior description.

From the preceding statement relative to machinery on the river, it will be observed that the amount of small lumber annually manufactured at these mills, is very large. This is mostly forwarded to market on rafts, and frequently being destined to different vessels or places from the lumber, occasions much inconvenience.

It is often necessarily moved several times before it is finally disposed of, and every change is of course attended with more or less expense. This lumber is also liable to losses in rafting, all which are proper charges to be added to the charge of transportation by the river. It therefore would appear reasonable to conclude, that nearly or quite the whole of this lumber would be forwarded to market by your road.

In connection with this subject it should be observed that there are a number of mills on or near the Penobscot river, above Milford, which manufacture, annually, from 3 to 4 millions feet of lumber, and a very considerable amount of shingles, laths, &c., &c. It is not supposed that the lumber once put into the river

above Milford, would leave it before it reaches Bangor. All of the small stuff, however, will probably take the rail road at Oldtown and Milford. It is estimated by one of the best informed dealers in Lincoln, that there are daily 100,000 shingles passing that place to the Bangor Market. This small lumber will doubtless reach the upper terminus of your road by boats and rafts during the season of navigation, and by teams at all times; but in much larger quantities in the winter season.

Ship timber may be regarded as a considerable item of trade on your road. The tonnage of vessels annually built in Maine, is nearly double that of any other State, or about 33 per cent. of the whole tonnage built in the United States. With the superior facilities which Maine possesses, in her extended coast, her numerous harbors and rivers, and the skill and enterprise of her citizens, she will maintain her ascendancy in this branch of business, over all other large ship-building States. The rapid increase of this business will create a demand for ship timber, and doubtless all rail road communications with the interior will receive large accessions to their tonnage from this article.

Railroad sleepers, fence posts, firewood, bark, &c., in large quantities, will find their way to market over your road. Many articles which are now comparatively shut out of the market on account of the cost of transportation, would, on the opening of your road, become of value in the market; and in amount, be vastly increased.

Few, if any, sugar boxes are now made in this vicinity; but with proper facilities for reaching market, this doubtless would become a large business. The same thing may be said of barrels, heading, shooks, hoop poles, hoops, and an almost endless variety of the productions of the forest.

With a superior railroad, terminating at one end on navigable water at Oldtown and at the other on the wharves of Bangor, whereby all descriptions of freight may be taken directly to vessels, or to that part of the city which will wholly or in part, relieve it of charges for truckage, this business must be vastly increased. All the above-mentioned articles would be brought down the river from remote towns, in large quantities, in boats and rafts to Oldtown, and by teams from the several townships in the vicinity of the terminus, as well as others not in the proximity of the river or the railroad.

From the preceding statement relative to the downward trade of your road, we may with some further reference to the nature of that trade and the statistics of the country, form a just conclusion as to the probable amount of the upward trade. This tonnage will be mostly merchandize for the supply of a large extent of country to the North and East, and the provision, forage, &c., for the lumber camps.

On the approach of the winter season, large numbers of men resort to this district from all parts of the State and from the Provinces, with a view to get employment for the winter in cutting and hauling logs.

It is estimated by good judges, that there are annually employed 3,000 horses and oxen, and 4,500 men, in this business.

In the several towns above Milford, in Penobscot County, and also those in portions of Washington, Hancock and Piscataquis, together with Aroostook County, there are probably 28,000 inhabitants. In the villages along the line of your road, including North Bangor, there is probably a population of not less than 6000, which, added to the above, gives a total of 34,000 inhabitants who will receive their supplies from Bangor, and who will contribute to the business of your road.

According to the estimate of intelligent dealers in produce, there are annually sold in the city of Bangor, 100,000 barrels of flour, 350,000 bushels of corn, and 10,000 barrels of pork and beef; and that there are annually sent up the Penobscot valley, and consumed by lumbermen and their teams, and by the inhabitants of the districts above mentioned, and the upper St. John, 50,000 barrels of flour, 250,000 bushels of corn and 6000 barrels of pork, &c. In addition to these supplies, there are other descriptions of provisions required, such as beans, butter, cheese, lard, fish, dried apples, &c. Also, other heavy articles of freight, such as large castings, cranks, wheels, stoves, hollow and hard ware, oil, molasses, tea, coffee, sugar, tobacco, salt, &c., &c.

In the section of country now under consideration, there are over 100 stores, from which some idea may be formed of the amount of merchandize annually passing up the Penobscot valley.

In view of the present amount of business, and the impetus that will be given to every branch of industry on the opening of a new channel of communication in this direction, it is believed that we can, with safety, place the amount of this freight at 20,000 tons, annually.

PASSENGER BUSINESS.

It now remains for us to consider the probable amount and value of this business to your road.

It will readily be seen from the large amount of manufacturing on your line and the dense population in its immediate vicinity, that the amount of travel will be very large.

The population of Bangor is probably at the present time, about 15,000, to which add that of Orono, Bradley, Oldtown, Milford and Brewer, and Eddington opposite Bangor, and Orono, respectively, and we have a total of 25,000 inhabitants on and near your line. It is not, however, this population alone to which you may look for support, but to that also of the country above Milford, whose business relations are altogether with Bangor, or in that direction. This, as before stated, amounts to 23,000, giving a total of 53,000 inhabitants, who, from the nature of their pursuits and habits of intercourse, will contribute to the passenger business of your road in a far greater proportion, than is usual for a like population under ordinary circumstances on other roads.

From the city of Bangor to North Bangor, a distance of 4 miles, there are stages running twice daily for 7 months of the year. From Bangor to Orono, stages run twice daily for the same portion of the year. Also to Upper Stillwater for 7 months in the year; one half of this time twice daily—for the remainder, once daily.

To Oldtown and Milford, there is usually a daily stage. There is also a daily line from Mattawamkeag to Bangor, called the Houlton line. In addition to the passengers conveyed by stages, there is probably a still greater number daily passing up and down the road by other conveyances. The constant intercourse between the numerous mills and the city, and the

great number of persons connected with the lumber trade, and other branches of business in the interior, who are constantly passing and repassing, are facts which warrant the conclusion that your road will secure a large passenger business. The saving in time effected by the rapid transit of railroad conveyance is an important consideration, and at a fair valuation, would be equal, for each passenger, to half the amount of his fare; while to a large portion, it would be double that amount.

In view of the present amount of travel and a reasonable increase which would immediately follow the opening of your line, there appears to be no doubt that the number of passengers transported on your road, will equal 80,000 annually.

With the foregoing data, we proceed to submit an estimate of the probable revenue of your road, when it shall be in full and successful operation, and its business connections completed.

ESTIMATED INCOME.

70,000,000 feet Lumber, including		
Boxes, Heading, &c.	at 55c pr. M.	\$38,500
50,000,000 Shingles,	" 12½c. " "	6,250
17,500,000 Clapboards, Pickets and Staves,	" 55c. " "	9,625
50,000,000 Laths,	" 10c. " "	5,000
30,000 Barrels,	" 3c. each.	900
8,000 Ship's Knees,	" 25c. "	2,000
100,000 Rail Road Sleepers,	" 3c. "	3,000
50,000 Fence Posts,	" 2c. "	1,000
20,000 Tons of other freight,	" 1,15c.	23,000
80,000 Passengers,	" 35c.	28,000
Mails,		725
		\$118,000
Deduct for expenses, 60 per cent.,		71,000
Net revenue,		\$47,000

This is equal to nearly 9 per cent on the total cost, as now returned.

In the above estimate we have allowed for the transportation of 70,000,000 feet of lumber, at the low average rate of 55 cents per thousand feet.

This is less than one half of the amount annually manufactured for several years in succession.

With this low rate and the superior facilities afforded for transportation, your road ought to command a still greater amount of this trade.

The amount of clapboards, staves, &c. in the estimate, is supposed to include not only those manufactured on the line of your road but those also that will be brought from Lincoln and all other places above Oldtown.

The other articles embraced in the estimate, are about the amounts now produced, or such as a moderate increase would give.

The expenses of roads generally, in New England, are about 50 per cent of their receipts, but as short roads are usually operated at greater proportional expense than long ones, I have deducted 60 per cent of the estimated gross income of your road for the expenses.

In other respects, it can be operated as cheap or cheaper than roads generally, and possibly the expenses may be reduced to 50 per cent of the income.

No one acquainted with the losses and difficulties attending the conveyance of lumber to market by the river, will doubt that a large amount of the best quality would go on the road, even at a greatly increased price from that above stated. The most skeptical will, I believe, admit that at 75 cents per thousand feet, there would be not less than 35 millions of feet of lumber pass over your road annually. So also, it is believed, that any one acquainted with the immense amount of travel on this route, must admit that there will be not less than 80,000 passengers transported annually.

To take the most unfavorable view of the case, suppose the income from lumber to be only for the amount and at the price above stated; that the fare for passengers is reduced to 30 cents each, and the annual net revenue will then be \$40,700, or over $7\frac{1}{2}$ per cent on the estimated cost.

In whatever light the preceding estimate of income may be regarded, no one after proper investigation of the subject, can doubt

the importance of your enterprise, or the great inducements it holds out for safe and profitable investment of capital.

It may be proper in this connection, to state that the estimate of the amount of lumber transported, is based on the present character of the trade, and that an increase of capital and manufacturing facilities may materially change the character of a large portion of the lumber transported, giving it a greater value at home, and justifying an increase in the rates of freight. If the work required to prepare lumber for building was performed at or near the mills, where it is now manufactured, a material benefit would be realized by the community whose labor is thus employed.

The preparing and fitting lumber for buildings, gives employment to a large population in every great city. A portion of this labor could be more economically done where the lumber is produced, with the aid of machinery now in common use. By introducing these improvements in your business, and by exporting your lumber in that form in which it shall have reached its highest value, you may gradually change the character of the business, and add to the population and wealth of your own State.

The immense water power of the Penobscot, will for all time to come, furnish a never failing source of business for your road, whatever may be the extent of the lumber trade. At various points on the line of your road, a large amount of water-power remains unoccupied, but which will doubtless soon be brought into use. That at Basin mills near Orono, at the Rose place, Corporation mills, and at Oldtown are highly valuable. At the former place, by cutting a short canal, the water of the whole Penobscot may be made available for manufacturing purposes, and the site will occupy a position entirely protected from floods and immediately on the line of your road.

At some future day, when the lumber business on the Penobscot may become diminished, so far from fearing any decline of prosperity from this cause, you can with great confidence, anticipate the application of its magnificent water-power to those other branches of manufacturing, which to other parts of New England have been such prolific sources of wealth.

New branches of industry will be called into existence by the opening of this new channel of communication, and the resources

of the country being more fully developed, will add vastly to the other products and sources of revenue.

The construction of your road, is but the addition of another link to the great central chain of railways through your State, which at no distant day, will be connected with the railways of New Brunswick, thus making this series of roads the great highway connecting the Lakes and the St. Lawrence with your State and the lower Provinces.

With the early completion of the Waterville and Bangor road of which there can be no doubt, there must be a great increase of trade and travel in this direction. The addition of over 60 miles to this grand trunk line, will, beyond a question, give a great impetus to business throughout this whole section of the State, and doubtless draw a large amount of travel from New Brunswick over this route.

To the City of Bangor, occupying as she does a commanding position at the head of tide-water, the commencement of a line of communication which is eventually to extend far into the interior, is a question of vital interest.

It is to the opening of communication with the *interior* that we may attribute the rapid strides which have been made in population, business and wealth, by the principal Atlantic cities.

Bangor is so situated as to derive great benefits from an interior communication, both from the East and the West. That your road will add to its business and wealth, does not admit of a doubt.

In other cities, the increased value of real and personal estate, mainly attributable to the introduction of railways, has been greater than the cost of their respective works; and it is reasonable to conclude that this must be the result with Bangor.

Increased value will be given to every description of property along the line of your road. The enhanced price of lumber in consequence of its not being put into the water, the increased facilities afforded by your road for its cheap, safe and expeditious conveyance to market and of forwarding supplies to the interior, will naturally add to the value of lumber lands. It would not be anticipating too much to suppose, that the construction of your road would add 25 cents per acre to all of the more valuable of these lands on the Penobscot.

The extension of your road up the Penobscot, which will undoubtedly be made in the course of a few years, will, while it increases the wealth and business of this section of the country, draw a large amount of trade to your line, which now is, in a measure, shut out from market from the expense of transportation, or which goes to Calais, or down the river to St. John.

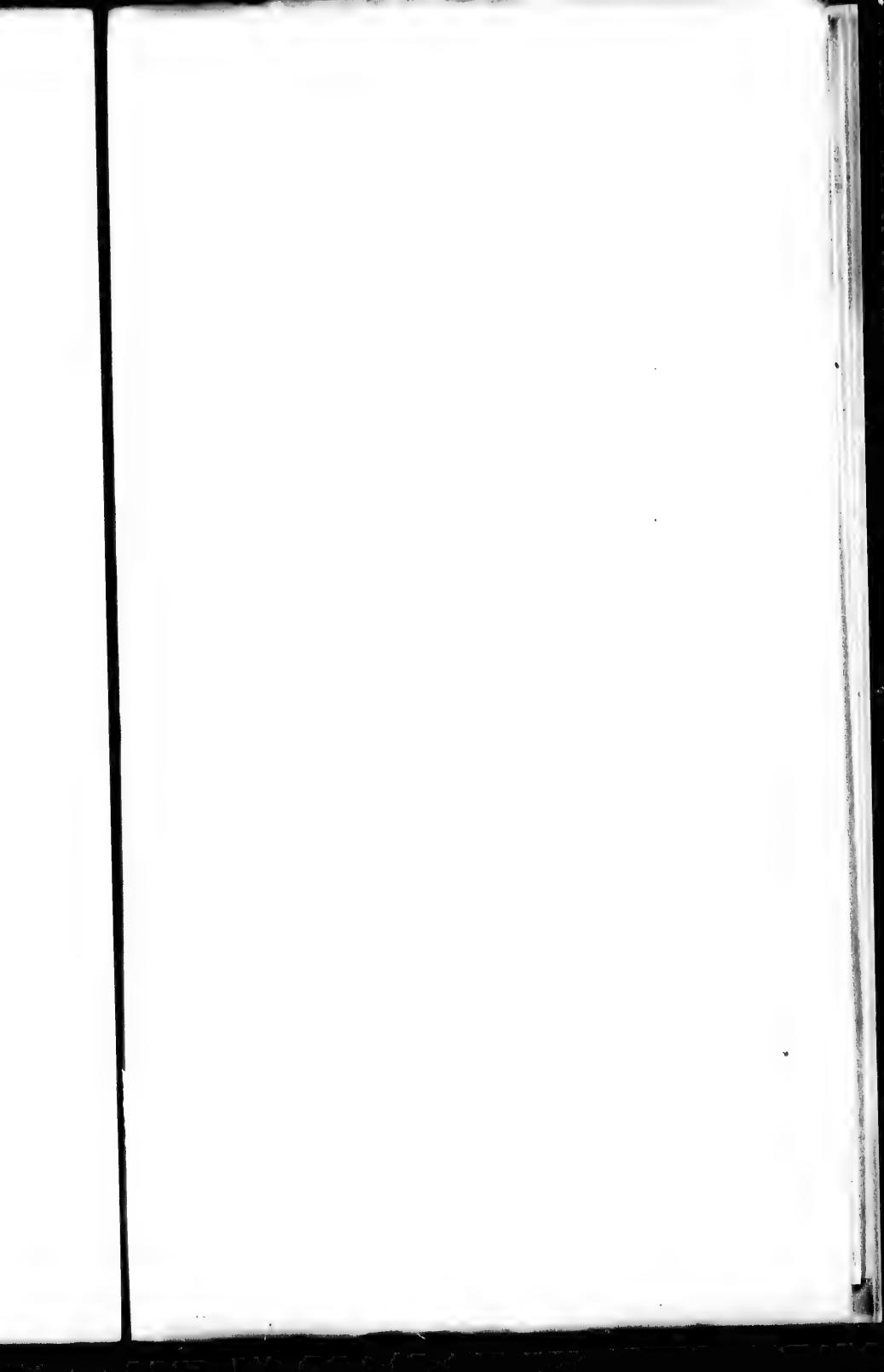
Among the important articles of trade which will then pass over your road, may be mentioned that of iron from the Katadhin works and slate from Brownville, of which there is said to be almost inexhaustible quantities.

In view of the large local business of your line, its position with reference to the country and trade of the Penobscot and its tributaries, and of the fact that it is, beyond question, to form part of the great line which will eventually reach the Lower Provinces—I say, in view of these considerations there can be no doubt but that your road will, immediately on its completion, prove a good investment, and continue to advance in value, as the business of the country is developed, and its communications are extended and improved.

In conclusion, allow me to express the obligation I am under to I. Washburn, Jr., Esq., for valuable statistical information, and to Mr. A. P. Robinson, and other gentlemen assisting him, for the energetic and skilful execution of the survey.

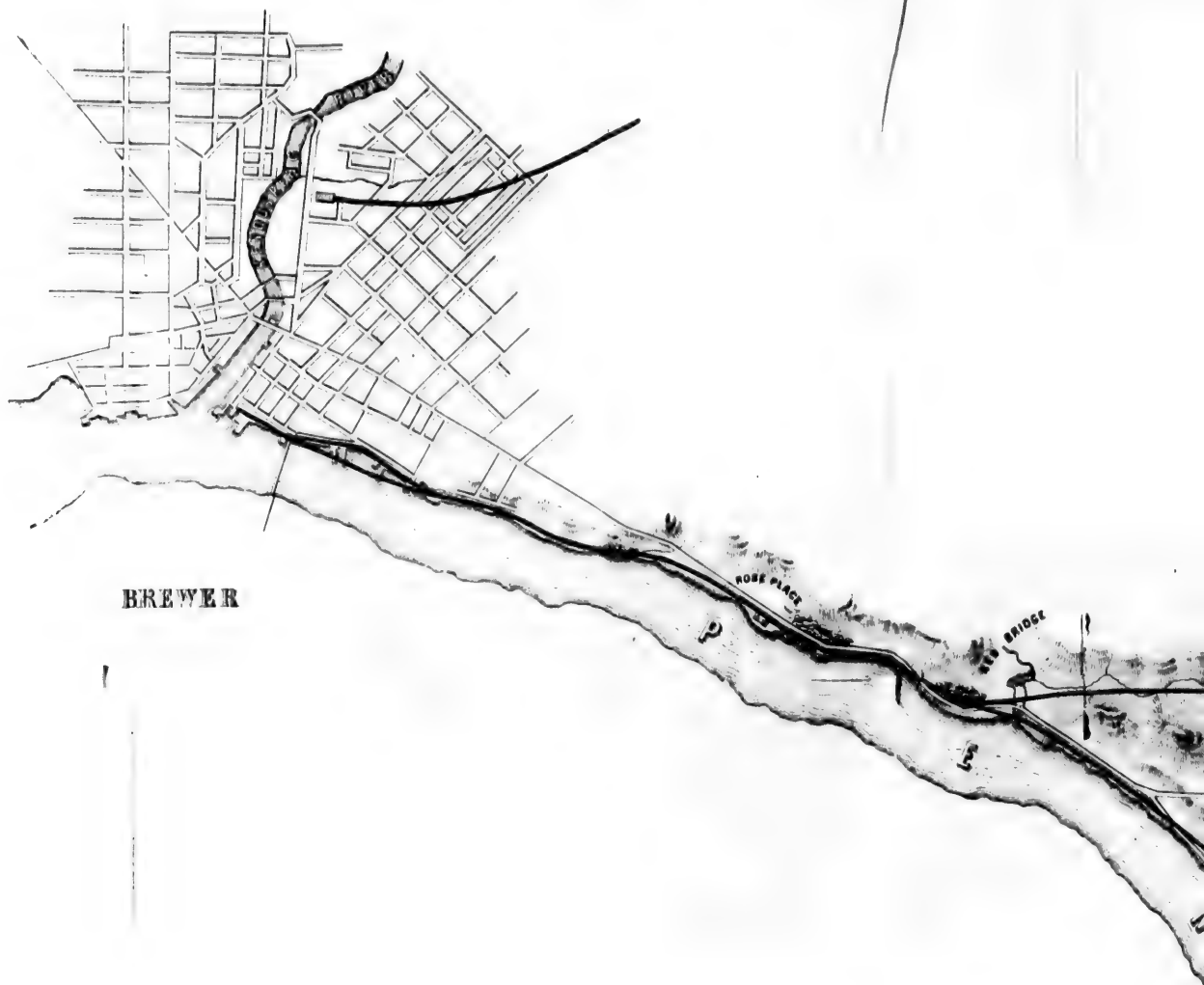
I have the honor to be,

Gentlemen,
Your obedient servant,
A. C. MORTON,
Civil Engineer.

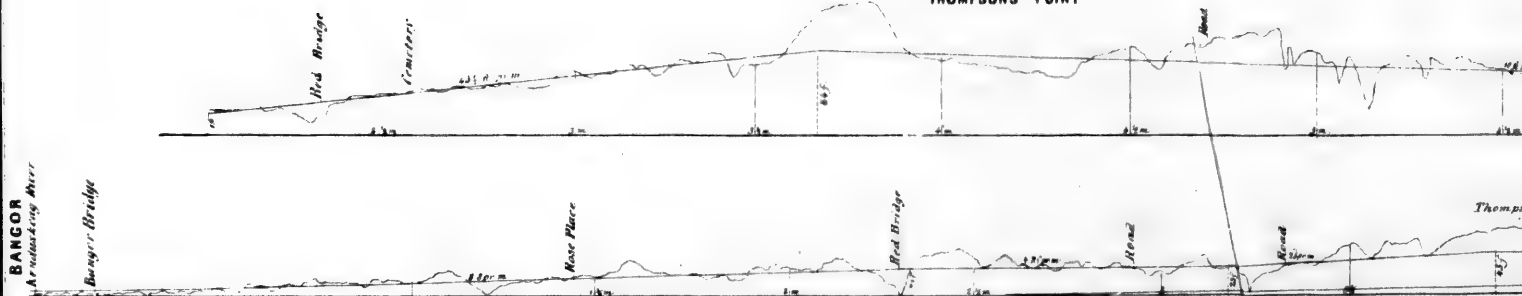




CITY OF BANGOR



PROFILE OF INTERIOR LINE AT
THOMPSONS POINT



M A P
 OF THE
BANGOR, ORONO & OLDTOWN
RAIL - ROAD.

Surveyed under the direction of **A.C. Morton.**

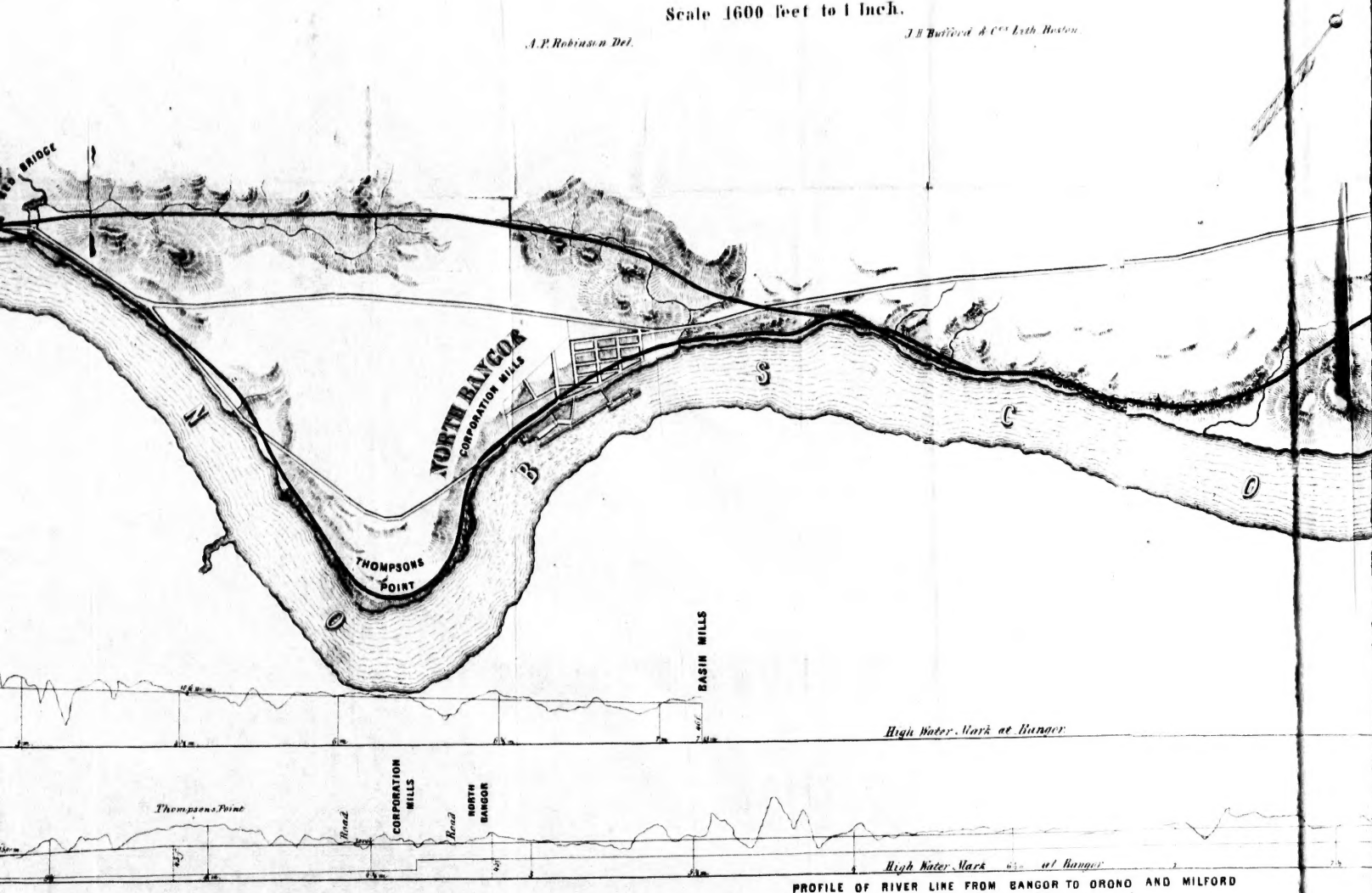
by *A.P. Robinson, Civil Engineer*

1850.

Scale 1600 feet to 1 inch.

A.P. Robinson Del.

J.B. Bulford & Co. Lith. Boston.



PROFILE OF RIVER LINE FROM BANGOR TO ORONO AND MILFORD

OLDTOWN

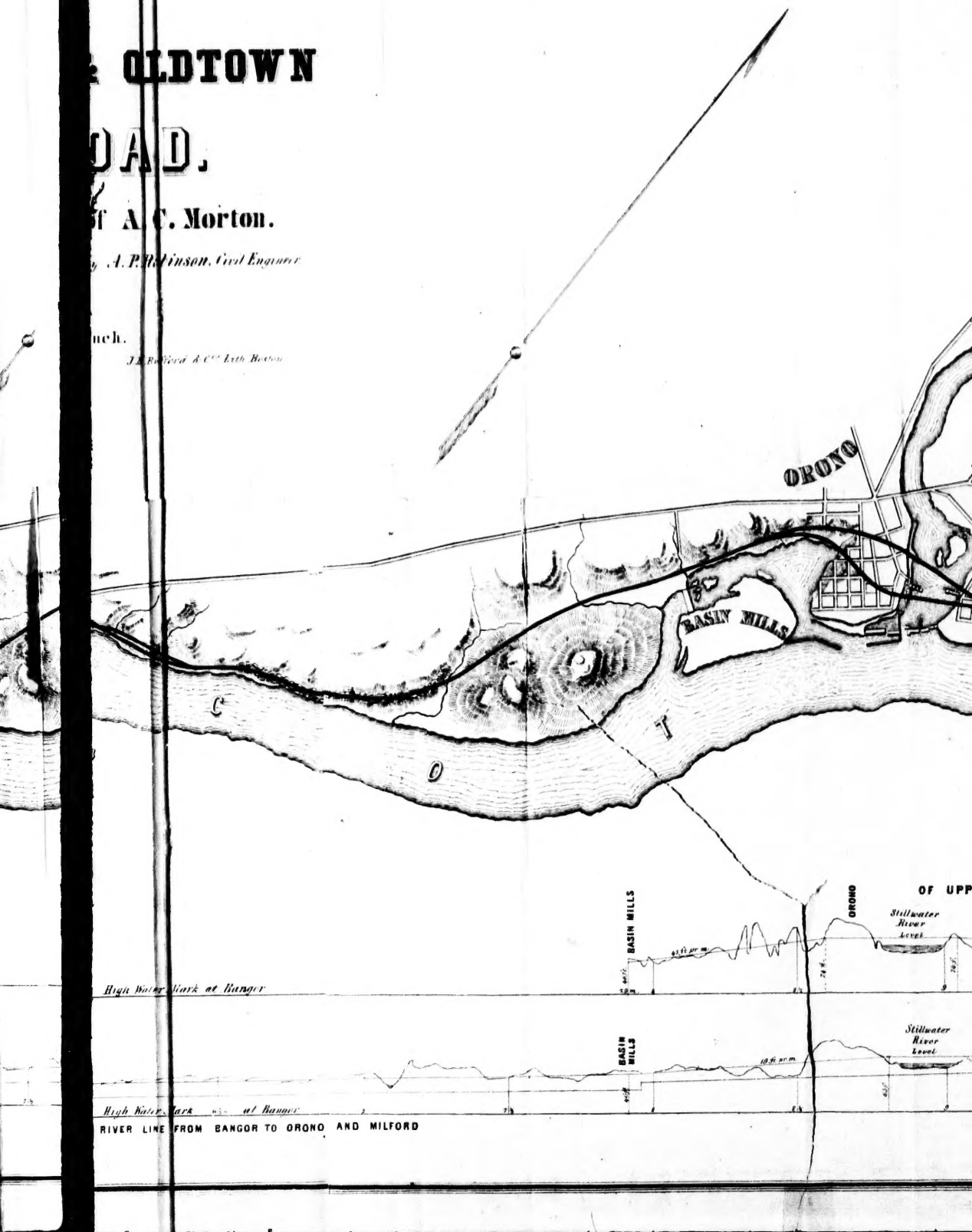
ROAD.

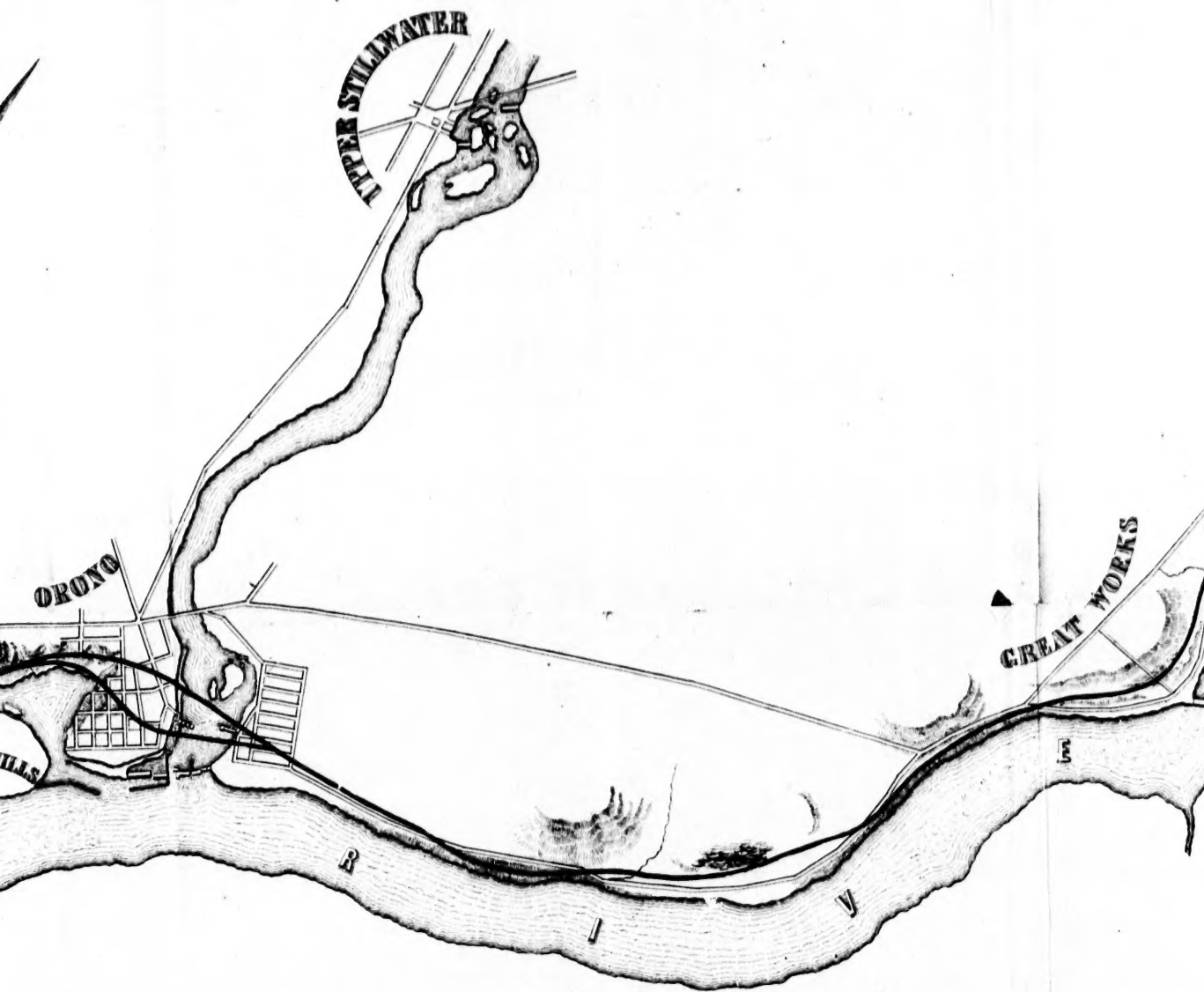
of A. C. Morton.

by A. P. Robinson, Civil Engineer.

inch.

J. B. Ford & Co. Lith. Boston.





PROFILE
OF UPPER LINE AT ORONO

